

PHILOSOPHY OF SCIENCE

An Introduction

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Originally, a paper submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at ACTS Academy of Higher Education, Bangalore, 2007.

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INTRODUCTION

Philosophy of science is a study of the general nature of scientific practice, explanations, theories, and the relation of scientific knowledge to philosophical issues.¹ It is that branch of philosophy that is centered on a critical examination of the sciences: their methods and their results.²

While philosophy is concerned with ultimate and fundamental issues, science is concerned with the identification and collection of information, plus the essential methods or procedures by which information is gained.³ Philosophy of science is a study of the nature and implications of what constitutes the activity and findings of science.

For purposes of this introductory guide, the issues of philosophy of science may be seen as divisible into three subject-groups: the epistemology of science, scientific metaphysics, and axiology of science.

Epistemology of science concerns the study of the nature and scope of scientific methodology and scientific knowledge. This branch of the philosophy of science studies the justifiability of the methods which science employs in scientific research. It also studies the nature of the scientific knowledge as reflected in scientific theories, laws, and explanations.

Scientific metaphysics concerns the study of the implications and relation of scientific results to the metaphysical problem of the nature of reality. In the process, it also explores the metaphysical presuppositions of certain cosmological and ontological theories of science like the theories of evolution, of relativity, and of quantum science.

Axiology of science explores the relationship between scientific knowledge and human values. Issues like human rights, equality, justice, good and evil, and politics have inseparable connections with cosmological, anthropological, and theological theories. Axiology of science studies the theories of values with respect to their relation to such theories.

In the following pages, a survey of the various branches of the philosophy of science will be given.

¹ Cf. "Philosophy of Science," *Microsoft Encarta Encyclopedia* (Microsoft Corporation, 2001); Harold H. Titus, Marilyn S. Smith, and Richard T. Nolan, *Living Issues in Philosophy*, 8th edn. (Belmont: Wadsworth Publishing Company, 1986), pp. 265-266

² Robert Audi (Gen. ed.), *The Cambridge Dictionary of Philosophy* (New York: Cambridge University Press, 1995), p. 611

³ John N. Moore, *Creation/Evolution* (Grand Rapids: Baker Book House, 1976), p. 11

1. EPISTEMOLOGY OF SCIENCE

Epistemology of science is that branch of philosophy of science that concerns the study of the nature and scope of scientific methodology, scientific knowledge, and scientific language.

1.1. Scientific Methodology

It is evident that science has existed since time immemorial. History bears record of great scientific accomplishments that humans have achieved in past three millenia. However, the modern generation has witnessed a greater rapidity of scientific progress than previous generations. Moreover, there has also been considerations about scientific research and methodology. This has also given rise to several problems in the epistemology of science.

1.1.1. The Problem of Induction. Francis Bacon (1561-1626), regarded as one of the pioneers of modern scientific thought, in his *Novum Organum*, laid down principles for an empirical method of science that emphasized induction through observation and experimentation.⁴ According to Bacon, hypothesis follows empirical observation and determines the method of experiment which in turn verifies the hypothesis giving rise to 'axioms' that guide further research.⁵ Bacon's inductivism greatly influenced the development of empiricism. However, philosophers soon saw the problems therein.

1.1.1.1. In his *An Enquiry Concerning Human Understanding* (1748), David Hume (1711-1776) questioned the assumptions of induction. According to Hume, all induction is based on a presupposition of the notion of causality. Predictions are made on the assumption that all reality is connected and causally related. In all reasonings related to fact, 'it is constantly supposed that there is a connection between the present fact and that which is inferred from it.'⁶ Causal relations are either near or remote, direct or collateral. For instance, heat and light are collateral effects of fire, and the one effect may justly be inferred from the other. However, Hume goes on, the knowledge of causal relation is not *a priori* but 'arises entirely from experience, when we find that any particular objects are constantly conjoined with each other.' Thus, causal relations are not necessary relations but only arbitrary ones. One sees a succession of things and by custom and habit imposes causal relation between them. There is no reason to suppose that a particular effect will always of necessity follow a particular event, even though experience shows that as happening. Thus, there are

⁴ "Francis Bacon, 1st Baron Verulam and Viscount St Albans," *Microsoft Encarta Encyclopedia* (Microsoft Corporation, 2001)

⁵ Will Durant, *The Story of Philosophy*, 2nd edn. (New York: Pocket Books, 1961), p. 133

⁶ David Hume, "There Are No Possible Grounds For Induction," *Classic Philosophical Questions*, 7th edn. (ed. James A. Gould; New York: Macmillan Publishing Company, 1992), p. 316

no rational grounds for induction. Hume further questions the assumption of induction that all nature is uniform. But, one's observation of a succession of events in the past may not guarantee the same if the belief in the uniformity of nature turns to be false. In fact, there is no *a priori* basis for assuming the uniformity of nature apart from some probable psychological inclination.⁷ Can one be sure that induction itself will continue to be reliable in the future? According to Peter Lipton, 'The nub of the problem is that the claim that induction will be reliable in future is itself a prediction, and so could only be justified inductively, which would beg the question.'⁸ Thus, scientific prediction on the basis of induction has no absolute grounds.

Several attempts to solve Hume's challenge have been made. However, the only possible answers seem to be those in which it has been attempted to demonstrate the scientific method as not being inductive but deductive. In other words, the problem of induction is solved by doing away with induction itself. Two chief answers suggested were by Immanuel Kant (1724-1804) and Karl Popper (1902-1994).

1.1.1.2. In his *Critique of Pure Reason* (1781), Kant attempted to ground the scientific method rationally in his theory of the categories of understanding. According to Kant, the mind is not a blank slate on which experience writes information. For if that is true then no geometrical or scientific knowledge would be guaranteed. According to him, the forms of intuition, *viz.*, space and time and the categories of understanding, like quality, quantity, and relation, are the means by which the mind arranges the influx of random data to facilitate understanding. Thus, some knowledge is always innate. The fundamental principles of science, like the law of conservation and causality, which are assumed in any scientific research are not obtained from experience but constitute the *a priori* knowledge of human understanding.⁹ Therefore, causal relations, according to Kant, are necessarily imposed by the human mind and constitute the rational basis of scientific research. Thus, causal relations are not induced but deduced from the fundamental principles of human understanding. Without such fundamental principles no scientific research could be possible.

1.1.1.3. Karl Popper's deductive interpretation of the scientific method proposes the falsification principle according to which scientific theories are hypothesis from which can be deduced statements testable by observation. If the appropriate experimental observations falsify these statements, the hypothesis is refuted. If a hypothesis survives efforts to falsify it, it may be tentatively accepted.¹⁰ Thus, a good

⁷ Shyam Kishore Seth & Neelima Mishra, *Gyan Darshan* (Allahabad: Lokbharti Prakashan, 2000), p. 222

⁸ "Philosophy of Science," *Microsoft Encarta Encyclopedia* (Microsoft Corporation, 2001); also see Hume, "There Are No Possible Grounds For Induction," p. 322

⁹ Immanuel Kant, "The Copernican Revolution in Knowledge," *Introduction to Philosophy* (ed. Louis Pojman; Belmont: Wadsworth Publishing Company, 1991), p. 145

¹⁰ "Sir Karl Raimund Popper," *Microsoft Encarta Encyclopedia* (Microsoft Corporation, 2001)

theory, according to Popper, would make a number of predictions that could in principle be disproved or falsified by observation.¹¹ However, no scientific theory can be conclusively established for there always remains the probability of falsification. This probability, however, doesn't undermine the value of a scientific theory, for it is no longer seen as derived from experience but logically deduced from a hypothesis.

1.1.1.4. Both Kant's and Popper's views seem only to advance the view that science has no method by which it can come to a certainty of scientific knowledge. Kant's phenomenalistic interpretation of noetic-mechanics leads to the view that scientific research is more an idealistic one than a realistic one. Scientific investigation cannot go beyond the categories of the mind. Therefore, no matter what the external world is like, it will only be seen as the categories allow them to be seen and not as the things are in themselves. On the other hand, Popper's view gives scientific research a pragmatic tinge. Nothing can be conclusive in science, since the probability of falsification always prevails. A science that assumes unfalsifiability is bad science. However, Popper's theory cannot be ignored. History of science has shown that theories have to be regularly revisited to explain newer discoveries and problems. Science as an empirical study that seeks universal knowledge will always involve a high degree of probability for humans are not omniscient with relation to space and time.

1.2. Scientific Knowledge

By 'scientific knowledge' is meant the body of scientific theories, explanations, and laws. The problem of scientific knowledge is related to the nature of scientific knowledge and its relation to truth and reality.

1.2.1. **Scientific Explanation.** By 'scientific explanation' is meant a statement that explains phenomena in scientific terms, i.e., on the basis of scientific theories and assumptions. There have been mainly three approaches to scientific explanation: the inferential view, the causal view, and the pragmatic view.

1.2.1.1. *The Inferential View.* According to this view, an explanation is a type of argument, in which statements expressing laws of nature occurring form the premises, and the phenomenon to be explained forms the conclusion. The premises may also be statements that describe antecedent conditions.¹²

¹¹ Stephen Hawking, *A Brief History of Time* (London: Bantam Books, 1988), p. 11

¹² Lyle Zynda, *Introduction to the Philosophy of Science: Lecture Notes* (Princeton University, Spring 1994; http://socserver.soc.iastate.edu/sapp/phil_sci_lecture02.html)

According to the deductive-nomological model of inference, advanced by Hempel and Openheim (1948), a scientific explanation is a deduction of a description of the phenomenon to be explained from a set of premises that includes at least one law of nature.¹³ The content of the explanation must be empirical, meaning that it must be logically possible for an observation-statement to contradict it.¹⁴

There are at least two problems related to the inferential view: the problem of *asymmetry* and the problem of *irrelevance*. The problem of asymmetry is that, contrary to the postulation of the inferential view, scientific explanation and prediction are not symmetric. For example, using the laws governing weather patterns, storm formation, and the effect of air pressure on the behavior of barometers, one can predict that when a barometer falls a storm will soon follow. Similarly, one can also predict that when a storm is approaching, the barometer will fall. However, neither of these are explanatory, since both are explained by antecedent atmospheric conditions.¹⁵ The problem of irrelevance is that this model permits irrelevant information to play the role of explanation. For example, from the premises ‘All men who take birth control pills do not get pregnant,’ and ‘John takes birth control pills,’ one can infer that ‘John will not get pregnant.’ However, the argument doesn’t constitute an explanation since John will not get pregnant whether he takes the pills or not. Though the former premise doesn’t appear to be a law, yet in science regular observation of phenomena lead to generalization of law; therefore, the use of such a premise to represent a law is not unjustified.

1.2.1.2. *The Causal View*. According to this view, an explanation is a body of information about the causes of a particular event,¹⁶ which also involves the events causal history. However, the causal view faces the problem of sufficient causal explanation. For instance, in events where any of the available laws may be applicable, as in the expansion of a gas container to which Boyle’s or Charles’ or the Pressure law is applicable, any of the laws could be explanatory though not necessarily constituting a causal explanation. Further, in cases where certain laws are explained by other laws, for instance in Newton’s explanation of Kepler’s laws of ellipses by deriving them from his own laws of motion and gravitation, the inference model seems to better suited than the causal one.¹⁷

1.2.1.3. *The Pragmatic View*. According to this view, an explanation is a body of information that implies that the phenomenon is more likely than its alternatives, where the information is of the sort deemed ‘relevant’ in that context, and the class

¹³ “Philosophy of Science,” *Microsoft Encarta Encyclopedia* (Microsoft Corporation, 2001)

¹⁴ Lyle Zynda, *Introduction to the Philosophy of Science*, Lecture 2.

¹⁵ *Ibid.*

¹⁶ Lyle Zynda, *Introduction to the Philosophy of Science*, Lecture 4.

¹⁷ Lyle Zynda, *Introduction to the Philosophy of Science*, Lecture 6.

of alternatives to the phenomenon are also fixed by the context.¹⁸ Accordingly, an explanation is an answer that provides relevant information that favors the event to be explained over its alternatives, as determined by the context, based on interests of those involved.¹⁹ Subjective interests define the contextual requirements of explanation. Thus, explanation is something relative to the subjective interest; the explanation is ‘explanatory’ to someone. The explanation tells why a particular event is more likely than its alternatives. However, since the why-question is relative to the subject who asks it, the answer is only ‘explanatory’ relative to that subject. The subjective context of the why-question consists of the presuppositions of the subject, the criterion of relevance assumed by the subject, and the alternatives known to the subject. The scientific explanation only tells why one alternative is more likely to happen over the other alternatives. This assumes the contextual relativity and subjectivity of scientific explanations. Scientific explanations, thus, serve pragmatic cognitive interests of the subject.

1.2.2. Theory-Reality Connection. One problem of the epistemology of science is to ascertain in what way scientific theories are related to the objective world itself. Two main theories in this connection are realism and instrumentalism.

1.2.2.1. Realism. Scientific realism is the view that scientific theories reveal the hidden structure of the world.²⁰ Consequently, the acceptance of a scientific theory involves the belief that it is true.²¹ Scientific realists do not claim that all current science is correct; however, they hold that scientific theories have approximate and substantial truthfulness and believe that future progress in science will lead to theories much closer to the truth. In other words, science is able to give a true and real picture of what reality is like in itself. Contrary to this assumption, Kant had argued that what reality is in itself cannot be known since all sense-impressions are acted upon by the forms and categories of the mind; consequently, space, time, causality, quantity, etc., are all mental impositions on reality. Therefore, nothing of reality can be known since one cannot go beyond one’s mind. However, to scientific realism such agnosticism and skepticism regarding knowledge is unacceptable. It sees in science an optimistic hope for progress of genuine knowledge regarding the world.

1.2.2.2. Instrumentalism. According to scientific instrumentalism, scientific theories are not descriptions of the invisible world but instruments for predictions about the observable world.²² The relation of a scientific theory to objective reality is with reference to utility. What concerns a scientific theory is not to tell what reality is like, but to be able to make predictions about the observable world. Some

¹⁸ Lyle Zynda, *Introduction to the Philosophy of Science, Lecture 2*.

¹⁹ Lyle Zynda, *Introduction to the Philosophy of Science, Lecture 6*.

²⁰ “Philosophy of Science,” *Microsoft Encarta Encyclopedia* (Microsoft Corporation, 2001)

²¹ Lyle Zynda, *Introduction to the Philosophy of Science, Lecture 17*.

²² “Philosophy of Science,” *Microsoft Encarta Encyclopedia* (Microsoft Corporation, 2001)

instrumentalists believe that scientific theories are similar to the circuits in an electronic calculator; they help make predictions but tell nothing about the world. On the other hand, a modern school of instrumentalism, known as *constructive empiricism*, holds that scientific theories do purport to tell something about the world; however, the only goal such theories serve are to make predictions. Scientists are not required to believe those theories to be true reflections of reality as it is. What ultimately matters is utility.

Thus, it is evident that the epistemic problem of scientific knowledge is related to the wider problem of knowledge itself. Its solution depends on questions like: Can reality be known? Is knowledge rational or empirical? Is truth relative or absolute? To realists the predictive success of scientific theories demonstrate the genuineness of the theories; however, to instrumentalists the predictive successes only prove that the theories have been useful, and nothing else.

2. SCIENTIFIC METAPHYSICS

Scientific metaphysics is the study of the implications and relation of scientific results to the metaphysical problem of the nature of ultimate reality. In this section, the implications of scientific theories like evolutionism, modern physics, neurology, and behaviorism will be studied in relation to metaphysical problems.

2.1. Evolutionism & Living Reality

Evolutionism concerns the problem of the origin and nature of living reality. Evolutionism, in science, refers to the theory that ‘the many complex organisms now existent descended or evolved from relatively fewer and simpler organisms.’²³ The hypothetical nature of evolutionism, despite accrument of evidences in support yet inability to verify in prediction or through experimentation, has led some to label it as being not a scientific theory but a philosophical one.²⁴

Supposed evidence for organic evolution comes from comparative anatomy, study of vestigial remains, embryology, blood and fluid tests of animals, examination of fossils, study of geographical distribution, domestication and experimentation, and classification.²⁵

The theory of evolution doesn’t simply end at ‘the fewer and simpler organisms’. The ultimate problem is how life itself originated. The religious or purely philosophical answers do not concern scientific metaphysics. However, though evolutionism has been labeled sometimes as religious and sometimes as philosophical, its claim to an empirical scientific methodology, generally allots it a place in physical anthropology. According to Duane T. Gish, the General Theory of Evolution is the ‘theory that all living things have arisen by naturalistic, mechanistic processes from a single primeval cell, which in turn had arisen by similar processes from a dead, inanimate world.’²⁶

Critics of evolution theory have pointed out that it fails to meet the criteria of a scientific theory. To Gish, for instance its failure consists in not being observed, not being subject to experimentation, and assuming the form of non-falsifiability.²⁷ Further, a verifiable prediction on the basis of evolution theory has never been successfully made and verified because an adequate theory to explain the mechanism has never been given. In fact, in order for such a theory to even exist, evolution must

²³ Milton D. Hunnex, *Chronological and Thematic Charts of Philosophies and Philosophers* (Grand Rapids: Zondervan Publishing House, 1986), p. 17

²⁴ Harry Rimmer, *The Theory of Evolution and the Facts of Science* (Grand Rapids: Wm. B. Eerdmans Publishing Company, 1935), p. 18

²⁵ Titus, Smith, and Nolan, *Living Issues in Philosophy*, p. 33

²⁶ Duane Tolbert Gish, “Creation, Evolution and Public Education,” *Philosophy and Contemporary Issues*, 4th edn. (eds. John R. Burr & Milton Goldinger; New York: Macmillan Publishing Company, 1984), p. 458

²⁷ *Ibid*, p. 459

be first observed, which has never been the case. Therefore, evolutionism cannot be regarded as science, at least in the sense in which all other scientific theories are concerned. However, as relevant to the subject and science and also philosophy, the fundamental assumptions of evolutionism need to be examined.

Evolutionism assumes that life is material. In other words, life is all about a right arrangement of atoms and molecules. On the basis of this assumption, it is supposed that a mixture of certain gases, energy, and water could have given rise to certain organic substances, like amino acids (the building blocks of proteins, including the all-important enzymes that control the chemical processes of life), and purines and pyrimidines (the building blocks of RNA and DNA).²⁸ Consequently, the sea would have become a 'soup' of prebiological organic compounds which would become conducive to the generation of some kind of a replicator that played a crucial role in the development of cells and the origin of life. What all these substances and replicators are is unknown to science. How all this happened is unknown to science. However, evolutionists seem to be sure that though they are not sure how this all happened, they are at least sure that it has so happened, although they have never observed it happening. Such kind of an approach seems to be too superstitious to some. But all of this proceeds out of a materialistic outlook that not only looks at the world as a machine but also looks at the organism also as a machine. Life, then, is not some spiritual element within the organism. It is simply the animation or growth caused in a material body due to some programmed materials that chanced to happen at random. The strength of belief in evolutionism despite such uncertainty in providing adequate scientific explanations cannot qualify evolutionism as a philosophy, which seeks not mere speculation but argument and reasoning to establish the absoluteness of truth. Consequently, theories that are based on evolutionism also may be as unreliable as evolutionism since it itself stands on uncertainty.

2.2. Modern Physics and Ultimate Reality

The major challenges to the problem of reality in modern physics have come from the theory of relativity and the quantum theory. The philosophical importance of both of their results will be overviewed here in order to appraise their contributions to metaphysics.

2.2.1. The Theory of Relativity. The theory of relativity is a theory of space, time and motion. Albert Einstein (1879-1955) published his paper on the special theory of relativity in 1905, in which he mathematically proved that motion is relative and not absolute. For this he assumed that light has a constant velocity that is never relative to any moving body. This, however, was not just an hypothesis for its factuality was

²⁸ "Evolution," *Microsoft Encarta Encyclopedia* (Microsoft Corporation, 2001)

proved by the Michelson-Morley experiment that the velocity of light was never affected by the velocity of the moving body emitting the light itself.²⁹ Another important principle on which the theory is based is that: a coordinate system (that with reference to which motion is measured) that is moved uniformly and in a straight line relative to an inertial system is likewise an inertial system.³⁰ Consequently, there is no way to detect absolute motion since the laws of physics are the same in all inertial systems and the coordinate system itself is an inertial system. But then how is it possible for the velocity of light to be constant, then?

According to Einstein, the special theory of relativity finally succeeded in reconciling both the principles logically by a modification of kinematics – i.e., of the doctrine of the laws relating to space and time.³¹ The constancy of time was ensured by the elasticizing and relativizing of space and time. Thus, in an inertial system moving relative to a coordinate system, the velocity of light emitted from it will appear to be constant; however, the space-time phenomenon of the inertial system will appear to have warped from the coordinate system's point of view. This space-time distortion is not merely mental but physical.³² The time of the moving object runs slower in relation to that of the coordinate system. Similarly, the time of the still object runs faster in relation to that of the moving object. To illustrate this, to a passenger in a train, a light beam emitted from a source on to a mirror vertically opposite to it would take exactly the same time (say 2) as the distance (say 4) divided by the speed of light (say 2) to be reflected back. To an outsider in a system relatively slower to the moving train, the velocity of light being constant, the light beam would have to traverse a longer distance diagonally (say 6) and therefore would take (say 3) time to be reflected back. This means that what is (2) to the passenger is (3) to the outsider. This implies that for the passenger time is slower than for the outsider, though from his perspective his time appears to be normal while the outsider's time (as represented by his clock) seems to run faster. The theory of relativity thus also came to see events as occurring not just in a three-dimensional space but in a four-dimensional space-time. The implications for space were that the moving object appears to have increased in its size in the direction of its motion to the coordinate system. On the other hand, to the moving object the coordinate system decreases in size.

In 1915, Einstein published his general theory which dealt with the problem of gravity. In it Einstein suggested that gravity was not a force like other forces, but was a consequence of the fact that space-time is not flat but curved or warped by the distribution of mass and energy in it. He went to suggest that the Newtonian notion of gravity as a force is useless. Bodies do not follow orbits because of being acted

²⁹ Bertrand Russell, *ABC of Relativity*, 5th rev. edn. (London: Routledge, 1997), p. 29

³⁰ Albert Einstein, "What is the Theory of Relativity?" *Ideas and Opinions* (New Delhi: Rupa & Co, 2002), p. 229

³¹ *Ibid*, pp. 229-230

³² Bertrand Russell, *ABC of Relativity*, p. 148

upon by gravitational force; instead, they follow the nearest thing to a straight path in a curved space, which is called a geodesic. A geodesic on the two-dimensional surface of the earth is called a great circle and, though circular and curved, it is the shortest path between two points. A geodesic in four-dimensional space-time is the shortest path between two points in space-time; however, bodies following it appear to take a curved path (orbit) in three-dimensional space.³³ This space-time warp theory had several implications as predictions. One prediction was that light-rays travelling geodesic paths (shortest paths) would appear to be curved near massive objects, e.g., a star, in space. The prediction was proved true by an observation of an eclipse in 1919. Another prediction was that time should appear to run slower near a massive body like the earth where the force of acceleration is great. This was tested in 1962 using a pair of very accurate clocks mounted at the top and bottom of a water tower.

According to Russell, the philosophical consequences of relativity are not so great as is supposed.³⁴ Russell may be right in many ways. For instance, the theory does not affect the rationality of logic. In fact, the logical attempt to reconcile conflicting principles produced the theory. However, the results of relativity do have some philosophical consequences for the conception of the universe. For instance, the warping of space-time seems to go against the common-sense view of space and time. It shows that time is not absolute but part of the physical universe, is 'elastic' and can be stretched or shrunk.³⁵ The same is also true of space. For epistemology, this only shows how experience can alter a rationally axiomatic geometry of space devoid of the dimension of time. It cannot just be assumed that the understanding of what a straight line is *a priori* has nothing to do with experience; for, relativity shows that such Euclidean conception receives radical alteration in consideration of moving bodies and an empirical hypotheses such as the uniformity of physical laws and the constancy of the velocity of light.³⁶ Obviously, geometry cannot be cosmically successful without the inclusion of experience.

The association of space and time with mass and energy raises several metaphysical questions. Is reality one or many? Is there a singular coordinate system that includes all these inertial systems? Is that coordinate system inertial or uninertial? If it is inertial, then it can only be so in relation to some other coordinate system which doesn't qualify it as an overarching coordinate system as such? But if it is uninertial, then is it infinite or finite? Further, in what way can space and time be applied to the concepts of immaterial beings like spirits? In what way can it be said that God is eternal: as enduring in time or as being timeless, since time is related to mass and

³³ Hawking, *A Brief History of Time*, pp. 32-33

³⁴ Bertrand Russell, *ABC of Relativity*, p. 148

³⁵ Paul Davies, "Time," *The Experience of Philosophy*, 2nd edn. (eds. Daniel Kolak & Raymond Martin; Belmont: Wadsworth Publishing Company, 1992), p. 91

³⁶ Cf. Albert Einstein, "Geometry and Experience," *Ideas and Opinions*, pp. 233-246

energy? Is there a rational (or empirical?) justification for applying such concepts to God? Such are questions that the theory of relativity raises against metaphysics.

2.2.2. The Quantum Theory. Also known as quantum mechanics in physics, quantum theory is related to the physics of subatomic particles and phenomena that are considered to be the building blocks of material reality. Two important foundations of quantum mechanics are the postulations of Max Planck (1858-1947) and Werner Heisenberg (1901-1976). Another important physicist in the development of quantum mechanics was Erwin Schrödinger (1887-1961). In fact, Heisenberg and Schrödinger get the credit for the origination of the quantum theory, though in very different mathematical formulations.³⁷ Planck postulated in 1900 that energy can be emitted or absorbed by matter only in small, discrete units called quanta. In 1927, Heisenberg formulated the uncertainty principle which states that the position and momentum of a subatomic particle cannot be specified simultaneously.³⁸ This is so because it is only by shining light on a particle that the future position or velocity of the particle can be known. However, it needs the light of a short wavelength to measure with precision the position of the particle. However, the smallest amount of light, according to Planck's theory, was a quantum. This quantum of light (as pack of energy behaving like a particle) would disturb the particle and change its velocity in a way that could not be predicted. Moreover, the only way for the light to be of shorter wavelength is for the quantum to be of a higher energy. But the larger the amount of energy, the greater the disturbance of the particle and the amount of uncertainty. This means that the more accurately one tries to measure the position of the particle, the less accurately its velocity is measurable, and vice versa.³⁹

The quantum theory that was formulated on the basis of this uncertainty principle saw particles as no longer having separate, well-defined positions and velocities that could not be observed; they had a quantum state, which was a combination of position and velocity.⁴⁰ Quantum came to see particles such as electrons having wave properties, depending on how one chose to observe it. A particle seen as a wave, obviously, has no particular point of location. In this way quantum mechanics introduced an unavoidable element of unpredictability or randomness into science. There is no deterministic reason why a certain particle, say an electron shot from the rear electron gun on to the screen, should follow a particle path to a particular point on the screen. A number of different paths can be predicted for it despite the target of the gun. This unpredictability meant that the universe at the subatomic level was not deterministic. Particles could pop into existence out of nothing without specific

³⁷ Stephen T. Thornton & Andrew Rex, *Modern Physics* (Fort Worth: Saunders College Publishing, 1993), p. 208

³⁸ "Quantum Theory," *Microsoft Encarta Encyclopedia* (Microsoft Corporation, 2001)

³⁹ Hawking, *A Brief History of Time*, pp. 58-59

⁴⁰ *Ibid*, pp. 59-60

causation.⁴¹

All this, obviously, has a number of philosophical implications. The first to be tackled is the law of non-contradiction. How can something like light be both wave and particle? Obviously, it can either be a wave or a particle: not both at the same time? Further, what does it mean that the measuring system determines whether something, say an electron, appears to be a wave or a particle? Does it mean that phenomenon is determined by intention or that reality is something quite different than what is given in phenomena as appearance? Another important point for philosophy is the breakdown of cause and effect in atomic systems. Classical physics left no room for freewill; however, the new mechanics is seen as a science that frees the future from bondage to the past. As J. J. G. McCue saw it, 'No murderer can plead Newton's Laws as the cause of his crime, nor can any physicist, however skilled at calculation, tell for certain which assemblage of particles will win the next Presidential election.'⁴² Finally, the theory makes it possible that the universe originated by itself out of nothing. It doesn't need a Creator. However, in order for that to be the laws of quantum physics must precede it. 'Quantum physics has to exist (in some sense) so that a quantum transition can generate the cosmos in the first place.'⁴³ Thus, the cosmological problem of philosophy seems to be inescapable despite the development of the new physics.

2.3. Brain Science and Conscious Reality

Modern studies in functions of the human brain have revealed that memory, understanding, reasoning, and imagination are all functions of the brain. Different parts of the brain are seen to possess different functions. The upper part of the brain, cerebrum, is associated with voluntary and conscious properties; the lower part, cerebellum, is associated with unconscious properties.⁴⁴ The cerebrum is divided into two hemispheres: the left and the right. The left brain functions are number skills, written and spoken language, reasoning, scientific skills, and right-hand control. The right brain functions are insight, 3-D forms, art awareness, imagination, music awareness, and left-hand control.⁴⁵ Damage to any part of the brain can result in an impairment of the particular function associated with that part. Obviously, such a view of brain has led to several philosophical problems like the identity and reality of self, the survival of self, the epistemic certainty of matter-generated 'truth', and the possibility of immaterial consciousness.

In his essay, *The Story of a Brain*,⁴⁶ Arnold Zuboff discusses the problems associated

⁴¹ Paul Davies, "Is the Universe a Free Lunch," *The Experience of Philosophy*, p. 429

⁴² J. J. G. McCue, *The World of Atoms* (New York: The Ronald Press Company, 1956), p. 478

⁴³ Paul Davies, "Is the Universe a Free Lunch?" *The Experience of Philosophy*, p. 430

⁴⁴ "Brain," *Microsoft Encarta Encyclopedia* (Microsoft Corporation, 2001)

⁴⁵ *Ibid.*

⁴⁶ Arnold Zuboff, "The Story of a Brain," *The Experience of Philosophy*, pp. 382-389

with reducing conscious experience to neurophysical processes. He first constructs a fictional case in which a man's brain is removed from his rotting body and kept in a special nutrient bath connected to some machine that could induce in the brain experiences identical with reality. For instance, to produce an experience of a pond-hole experience, the hypothesis would be: 'The brain lying in its bath, stripped of its body and far from the pond, if it were made to behave precisely as it naturally would under such pond-hole circumstances, would have for the young man that very same experience.'⁴⁷ The first of the problems faced was when the scientists found one morning that the brain of their friend had been split into its two hemispheres by the watchman in his drunkenness. After much discussion, it was finally agreed that the two hemispheres need not be connected at all in order to restore the normal pattern: each hemisphere in a separate bath could be induced to produce the patterns similar to the connected state; thus, it was opined, the left hemisphere would be induced to behave in a way similar to its receiving impulses from the right hemisphere, and so vice versa. Thus, actual causation was no longer required for the production of the man's experience of self and the world. And so, separation of the brain hemispheres, it was thought, would not destroy the identity of the self in experience. Later, the problem took a new turn when one scientist replaced a damaged neuron with a fresh one; which brought to surface the assumption that a change in neural identity would not affect the experience of personal unified identity and experience. The whole problem tends in the way to the conclusion that if computers with functions similar to brain could be constructed, then two or three or more computers (without even being synchronized) could be programmed to produce patterns that would give rise to all such computers experiencing a unified self without even knowing what they are in reality and experiencing something quite different from what they really are.

In his paper, *The Matrix as Metaphysics*,⁴⁸ David J. Chalmers revisits the above problem with reference to the movie *The Matrix*, at the beginning of which Neo 'thinks that he lives in a city, he thinks that he has hair, he thinks it is 1999, and he thinks that it is sunny outside.' However, in reality, 'he is floating in space, he has no hair, the year is around 2199, and the world has been darkened by war.' In fact, 'Neo's brain is located in a body, and the computer simulation is controlled by machines rather than by a scientist.'

This matrix hypothesis, according to Chalmers, should be taken seriously. First of all, as Nick Bostrom suggested, it is very well possible that, in future history, technology will evolve that will allow beings to create computer simulations of entire worlds. In a vast number of computer simulations it is possible that there may well be many more beings who are in a matrix (computer simulation of world) than beings who are not. In that case, 'one might even infer that it is more likely that we are in a matrix

⁴⁷ *Ibid*, p. 383

⁴⁸ <http://www.u.arizona.edu/~chalmers/papers/matrix.html>

than that we are not.’ In fact, it is impossible to know whether we are or are not in a matrix already. The consequences of such a hypothesis are very serious. In Chalmers’s own words:

The Matrix Hypothesis threatens to undercut almost everything I know. It seems to be a *skeptical hypothesis*: a hypothesis that I cannot rule out, and one that would falsify most of my beliefs if it were true. Where there is a skeptical hypothesis, it looks like none of these beliefs count as genuine knowledge. Of course the beliefs *might* be true ... but I can’t rule out the possibility that they are false. So a skeptical hypothesis leads to *skepticism* about these beliefs: I believe these things, but I do not know them.⁴⁹

Chalmers’s solution to the problem is by showing that the matrix hypothesis is not a *skeptical hypothesis* but a *metaphysical hypothesis*. For this he takes help from the creation-hypothesis model that sees this world of experience as created by a being or beings, the computational-hypothesis model that sees computational reality as underlying simulated reality, and the mind-body hypothesis that sees mind and body as separate but interacting realities. As a metaphysical hypothesis the Matrix Hypothesis implies the existence of the external world which is the source of the inputs for simulation of reality. The matrix world is relatively real. However, it may be objected that a simulated world is not real. To this Chalmers replies that it is still clearly possible that a computational level underlies real physical processes. Thus, what is experienced within a matrix also would be reality.

The matrix problem is all dependent on the assumption that conscious reality is determined by the brain. Of course, there are evidences that seem to support this supposition. However, since they are all empirical they are not decisive, being open to falsification. It is very well possible that the assumption that equals brain with mind is false. In that case, the matrix hypothesis would lose ground. Moreover, the matrix hypothesis permits infinite spirals of matrixes. For instance, it is possible that four scientists invent a matrix in which there are four scientists who in turn within that matrix invent a matrix in which are four scientists and so on *ad infinitum*. However, an infinite spiral of matrixes is a finite impossibility for, with respect to the second law of thermodynamics, there is a limit to useful energy. It may be objected that this sense of a law of thermodynamics is ‘programmed’ into our brain and not really true. In that case then, man himself could not come to know the truth by himself. But if man cannot come to know the truth by himself then how can he know that the proposition ‘man cannot come to know the truth by himself’ is also true? Thus, in order for truth to exist, humans must be free from the deterministic clog of simulators or matter-conditioned consciousness such as the brain.

⁴⁹ *Ibid.*

In that sense, then the Biblical view of man as created in the image of God as a rational, moral, volitional, and spiritual being does better to not only save the phenomena but to also render humans responsible for their choices and actions.

3. AXIOLOGY OF SCIENCE

Axiology of science explores the relationship between scientific knowledge and human values. Issues like human rights, equality, justice, good and evil, and politics have inseparable connections with cosmological, anthropological, and theological theories. In this section, the results of scientific research will be seen in relation to the problem of values.

3.1. Darwinism and Social Values

In the narrow sense, Darwinism refers to the theory of organic evolution presented by Charles R. Darwin (1809-1882). In the broad sense, Darwinism refers to the body of scientific, social, theological, and philosophical thought that was historically stimulated by Darwin's theory of evolution.⁵⁰ Darwin's theory of organic evolution emphasized the principle of natural selection, which also is the theory of the survival of the fittest. Another mechanism that Darwin described was the 'struggle of males for females,' i.e., sexual selection. Thus, the whole panorama of life was a struggle for existence, a struggle for survival. Darwin's theory, though now rejected by many evolutionists, was a historical mega-event. Almost every department of science including theology was affected by it. Herbert Spencer (1820-1903) applied it to sociology. Its influence can be seen in the philosophies of Friedrich Nietzsche (1844-1900), Henri Bergson (1859-1941), and Alfred North Whitehead (1861-1947). Nietzsche, having seen the direction of atheistic science, declared the death of God in both science and theology. It must be noted, however, that Darwin himself did not advance atheism. In fact, he is said to have admitted a Creator.

To account for the existence of matter and life, Mr. Darwin admits a Creator. This is done explicitly and repeatedly. Nothing, however, is said of the nature of the Creator and of his relation to the world further than is implied in the meaning of the word.⁵¹

However, an acceptance of Darwin's theory, ultimately would mean a disbelief in the authority of Scriptures and the undermining of religion and even the end of values specified by the Scriptures. Nietzsche predicted that the death of God also meant the death of sinners. If God was dead no act constituted sin against God.⁵² While to some survival assumes value,⁵³ to some others will-to-power assumes value.⁵⁴ To sum it up: values become self-centric.⁵⁵ Social Darwinism came to see human

⁵⁰ Titus, Smith, Nolan, *Living Issues in Philosophy*, p. 31

⁵¹ Charles Hodge, *What is Darwinism?* (eds. Mark A. Noll & David N. Livingstone; Grand Rapids: Baker Books, 1994), p. 78

⁵² Friedrich Nietzsche, "The Overcoming Man," *Issues in Religion*, 2nd edn. (ed. Allie M. Frazier; Belmont: Wadsworth Publishing Company, 1975), p. 38

⁵³ C. Stephen Evans, *Preserving the Person* (Illinois: InterVarsity Press, 1979), p. 55

⁵⁴ Dr. Nilima Singh, *Nietzsche: Zarathustra Ne Kaba* (New Delhi: Hind Pocket Books, 2004), p. 96

⁵⁵ *Ibid*, pp. 48, 49

progress as dependent on competition. According to it, the fittest among humans survive. This influenced the eugenics movement which aimed at improving the quality of human population through selective breeding. Both Nazism and Fascism found in Darwinism their bases. The Nazis used the 'survival of fittest' principle as developed in the eugenics movement to justify their extermination of Jewish population and other ethnic groups. Thus, Darwinism influenced an anthropological perspective in which the breed became more important than the individual, while war and violence were justified as integral to the struggle for existence. The two World Wars saw how destructive the will-to-power could become. Post-war literature, especially, existentialist, recounted the Darwinian theme of the givenness or forcedness of life in a world of absurdity. Of course, Darwinism itself was not the only influence behind the development of such themes; there were other influencing philosophical developments as well. However, the gigantic figure of Darwinism overarching all such atheistic enterprises could not be overlooked. Values came to be seen as something not determined prior to existence, for human existence was not intelligently designed but was the result of blind chance. However, since man was both intelligent and free (absurd freedom),⁵⁶ he had to decide what constituted value for himself. Since man cannot ground himself in divine reality, he experiences forlornness; however, it also means that there are no given values or commands to turn to:⁵⁷ man must invent meaning for himself. Thus, an emphasis on the individual subjectivity of values was seen, against the Darwinian species emphasis. However, the absurdity of life and the absence of pre-determined values was assumed as non-existent.

Though Darwin's theory is rejected by many evolutionists, the principle of natural selection has become a part of evolutionism, though with certain modifications, for instance, of being understood in genetic terms rather than in terms of species. However, it must be affirmed that evolutionism is not the only theory of origins available. Creationism is also an important theory held by many scientists. It is not the concern of this paper to prove which of them is true, for that would take a whole essay itself. In relation to values, however, Darwinism fails greatly even as history proves. There is a danger of extremism and fundamentalism in religion. However, to regard such instances of extremism as proofs against the validity of any religion only destroys caricatures, the straw man. Religious practices are only religious if they are consistent with the teachings of the particular religion. Yet, in religion one has a way of anchoring his faith in some absolute. But, atheistic evolutionism provides no such anchoring ground.

3.2. Ethics of Science

⁵⁶ Albert Camus, "The Myth of Sisyphus," *The Experience of Philosophy*, p. 471

⁵⁷ Jean-Paul Sartre, "Existentialist Ethics," *Classic Philosophical Questions*, pp. 176, 177

Ethics of science refers to ethical problems involved with scientific research, discoveries, and inventions. In scientific research and invention, experiments on humans, invention of biological weapons, etc., are scientific issues that assume ethical importance. In the field of medicine, ethical problems are associated with issues such as medical research, genetic manipulation, abortion, and euthanasia. In the field of environmental concerns, environmental ethics assumes an important place.

The general issues that give rise to ethical questions concern scientific research and invention. In 1964, an experiment was carried out by the American psychologist Stanley Milgram that involved fooling people into thinking they were inflicting increasingly severe electric shocks on unseen but protesting victims. This experiment raised the ethical issue of whether it was morally right for a scientist to encourage people to inflict pain on others for experimental purposes.⁵⁸ The issue of the invention of biological weapons that could affect civilians is an ethical one in the sense that it concerns the rightness or wrongness of harming civilians in war. The whole issue revolves around the concept of crime against humanity. One another issue related also to medicine is the issue of cloning, in which humans prescribe the genes of clones. How would a cloned child see his individuality after knowing that he was a clone? Wouldn't he feel his individuality as forever compromised? What if things go awry in the cloning process? Would that constitute crime against a human? Who would be held responsible if things go awry?⁵⁹

3.2.1. Medical Ethics. Medical ethics is the study of moral standards in relation to the field of medicine. The ultimate issues underlying medical ethics are issues such as the definition of life and the value of life that are seen in perspective of ethical theories regarding what differentiates good acts and principles from evil. Two of the problems, *viz.*, medical research and genetic manipulation will be discussed here.

3.2.1.1. Medical Research. Research in medicine has the objective of alleviating human pain. However, this requires a study of how the human body works and what new drugs could be safely used to alleviate human pain. Things like experiments with embryos and test of drugs on humans assume ethical character when considering issues such as the value of life and the *moral* aim of medicine. For instance, during the 1980s there was a widespread debate about the ethics of research using human embryos. In such research, the embryos used were destroyed after 14 days from fertilization. The argument that ended the debate in UK leading to the legitimizing of such research, up to the 14-day limit, was that a pre-14 day embryo was not in a state to be treated as an individual person since its cells were not differentiated to fulfill specific functions along with the possibility that the embryo was still in a condition to split into two identical twins. The 14-day limit assumed that since the nervous system

⁵⁸ "Experiment," *Microsoft Encarta Encyclopedia* (Microsoft Corporation, 2001)

⁵⁹ "Cloning," *Microsoft Encarta Encyclopedia* (Microsoft Corporation, 2001)

begins to develop at about the 15th day from fertilization, there was nothing ethically wrong in destroying it on the 14th day, since the embryo doesn't know that it is a person.⁶⁰ This also justifies abortion before the 14th day and provides a kind of ethical basis for research in human cloning.

The several assumptions behind the legalizing of embryo research are that ethics is related to persons and not to potential persons, that personality is a matter of nervous system and not the organism housing such system, that humans are not accountable to anyone other than humans for what they do with any phenomenon of life; in other words, since God or some absolute judicial system doesn't exist, humans can decide what is to be done with humans. Such assumptions, however, cannot be accepted as axiomatic; they are philosophical issues, of course, but also so crucial as pertaining to human life itself. In their ultimate development, such issues are settled according to the religious or anti-religious mind-set of the political or judicial system in which the issues are raised.

3.2.1.2. *Genetic Manipulation.* The problem of genetic manipulation concerns the ethical rightness of gene replacement to rid the organism of harmful genes such as those responsible for inherited disease. Though scientists may offer positive results such as extermination of some diseases, the uncertainty of what other effects such manipulation will have on future generations makes genetic manipulation an ethical concern. In cases of animal cloning, for instance, an error in the procedure would justify the destruction of the cloned group. However, can such things be done to humans. Can humans be treated as impersonal things whose physical elements could be manipulated according to the interest or desire of some scientist or people? These are issues that cannot be simply resolved scientifically. They are philosophical issues that are based on several structural assumptions that act like axiomatic beliefs but are in reality not objectively justifiable. If, however, it is argued that objective justification is unnecessary, then ethics itself becomes a volatile issue and no longer the subject of philosophical research that seeks an objective reason for any belief or supposition. Thus, medical ethics becomes an issue of philosophical concern.

3.2.2. **Environmental Ethics.** Environmental ethics is that field of applied ethics which is concerned with those issues that arise when human beings interact with the natural environment. One debate among environmental ethicists relates to natural environment can be exploited for human interests, 'or whether it has significance independent of any use that might be made of it, a value that ought to constrain certain practices.'⁶¹ Some commentators feel that the Genesis account of man being given dominion over creation is the root of present environmental problems. Others, however, feel this as a misinterpretation. The Biblical concept of dominion doesn't

⁶⁰ "Medical Ethics," *Microsoft Encarta Encyclopedia* (Microsoft Corporation, 2001)

⁶¹ "Environmental Ethics," *Microsoft Encarta Encyclopedia* (Microsoft Corporation, 2001)

mean that man is given the right to exploit nature but has been given stewardship of it. Thus, human relation with environment is seen in light of divine law and order. Accordingly, Brunner writes:

Man is not called to an absolute, arbitrary mastery of Nature, but to a mastery of Nature which remains under the order of the Creator, and therefore honours and loves the created universe as God's creation.⁶²

However, the modern urgency in environmental ethics was sparked by studies showing the eventuality of environmental death due to pollution, deforestation, and other man-inflicted environmental damage. It is a debate in environmental ethics whether environmental ethics should be anthropocentric or eco-centric, whether morality is restricted to humans alone or is extended to nonhuman animals as well. The eco-centric ecologists, also known as 'deep' ecologists, see in anthropocentrism the root problem of ecological crises. Others, known as eco-feminists, think the root problem lies in patriarchalism, which permits the exploitation of both women and nature as subservient to men.⁶³ However, the chief thing to be decided is regarding what constitutes 'the good' or 'the evil' in relation to environment. In anthropocentric ethics, for instance, it may be argued that an ecological balance ultimately results in the good of humans. However, it is not certain as to how such ecological balance can be achieved, seeing that several species have already been extinct. Thus, ethical decisions come in need of more environmental research in order to protect environment itself.

One more ethical issue of human relation with nature concerns the legislations regarding protection of species and prevention of cruelty against animals. Some of the legislations appear to value a certain species of animal above any human. The nature of law, thus, comes into question. What is the real purpose of law: to ensure civil order or to protect animal species or both? Thus, environmental ethics raises several questions in science, religion, and philosophy.

⁶² Emil Brunner, *The Christian Doctrine of Creation and Redemption, Dogmatics: Vol. II* (tr. Olive Wyon; Philadelphia: The Westminster Press, 1952), p. 68

⁶³ Brooke Noel Moore & Kenneth Bruder, *Philosophy: The Power of Ideas*, 3rd edn. (California: Mayfield Publishing Company, 1996), p. 264

CONCLUSION

Science does pose several philosophical problems. For instance, it has been seen that the method of scientific enquiry itself raises several questions in epistemology. The problem of induction was whether it could lead to a certainty in scientific knowledge or not. Further, the nature of scientific knowledge itself becomes a problem revolving around the theories of realism and instrumentalism. To some, scientific knowledge is real knowledge of the world, while to others it is only useful knowledge.

It has also been seen that science also gives rise to several metaphysical concerns; few of which discussed were the cosmological and ontological implications of modern physics, the metaphysical implications of evolutionism, and the relation of brain and conscious reality. Finally, the axiological problem of values was seen in relation to Darwinism and Science Ethics. Several issues such as cloning, genetic manipulation, and environmental concerns were seen as relating scientific concerns to ethics.

It is indubitable that science has achieved a powerful momentum of progress all over the world. However, there are several things that science cannot solve for itself; it relies on other disciplines such as philosophy for help. Similarly, one also cannot rule out the relation of religion to science. Einstein said that the cosmic religious feeling is the strongest and noblest motive for scientific research. He points out, for instance, that it was a deep conviction of the rationality of the universe and a yearning to understand that enabled Kepler and Newton 'to spend years of solitary labor in disentangling the principles of celestial mechanic.'⁶⁴

According to Einstein, science itself cannot specify the purpose of human aspiration. Science only tells us how facts are related to, and conditioned, by each other. He says that objective knowledge provides us with powerful instruments for the achievements of certain ends, but the ultimate goal itself and the longing to reach it must come from another source. This sense of ultimate and fundamental ends cannot come from mere thinking. They come through revelation, through the medium of powerful personalities.⁶⁵ According to Einstein, the highest principles for our aspirations and judgments are given to us in the Biblical tradition. This revelation gives a sure foundation to our aspirations and valuations. The ultimate goal in the Bible, according to Einstein is: 'free and responsible development of the individual, so that he may place his powers freely and gladly in the service of all mankind.'⁶⁶ Biblical revelation has no room for the divinization of a nation, of a class, or of humanity. To Einstein, the Bible reveals that 'the high destiny of the individual is to

⁶⁴ Albert Einstein, "Religion and Science," *Ideas and Opinions*, p. 39

⁶⁵ Albert Einstein, "Science and Religion," *Ideas and Opinions*, pp. 42, 43

⁶⁶ *Ibid*, p. 43

serve rather than to rule, or to impose himself in any other way.’⁶⁷ An undermining of such high principles, according to Einstein, is only to the detriment of the individual and society. Thus, religion does have significance for science, in one way.

Philosophy, however, is not similar to religion. While religion offers fundamental answers, philosophy asks fundamental questions and evaluates the answers. In relation to science, then, philosophy asks fundamental questions in science; some of them like cosmological and ethical issues are answered by religion in some way or the other; philosophy comes again to evaluate those answers, not skeptically but with the purpose of knowing the truth. Thus, philosophy, science, and religion come into meaningful relationship. Ultimately, then it has been shown, that philosophy of science itself has come to need religious revelation as an aid. There are still many more complex questions related to all this that need to be answered. It is hoped that continuing research in the philosophy of science, along with the aid of divine revelation, will be able to solve much that cannot be solved by reason alone.

⁶⁷ *Ibid*, p. 43

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